the building, laid with adequate fall, and continued to a hedge ditch or other suitable outlet. Hence the level of the subsoil water is lowered to that of the drain, eliminating pressure on the vertical damp proof course, as the water passes through the open joints of the drain and is removed.

Another form of internal vertical damp proof course is shown at G. The wall is constructed in two block-bonded thicknesses with a continuous double layer of asphalt between, the height of the blocks being five courses each.

The detail at E shows the vertical asphalt applied on the external face of the walls. The joints must be well raked out to afford an adequate key for the asphalt, otherwise there is a risk of the covering becoming detached from the wall. There should be a minimum width of 2-ft. 6-in. working space between the wall and the timbering of the trench to enable this to be done. In order that the asphalt will not be exposed to view and the hot rays of the sun, it is turned in $4\frac{1}{2}$-in. just below the ground level and continued vertically to the upper horizontal course. This method is not so efficient as either of those shown at C, D and G, especially if the damp proof course is subjected to subsoil water pressure. The construction of the floor, in which Bull Dog clips are employed, is described on p. 38, Vol. III.

Detail F shows the application of sheets of fibrous asphalt felt. This bituminous sheeting is generally in 3-ft. widths and is laid vertically with 3-in. wide lapped joints. In the given example it is shown applied to the internal face of the main $1\frac{1}{2}$-brick wall. This face is first rendered with cement mortar (1 : 3) of $\frac{3}{8}$-in. thickness to provide an even surface for the sheeting.

It is usual for three men to work together when applying the felt. The roll is supported by two men holding the projecting ends of a wood roller which is passed through it. Commencing at the upper horizontal damp proof course previously laid, and working downwards, the underside of the roll as it is gradually uncoiled is heated by a blow lamp manipulated by the third man. Meanwhile, one of the other men holding an end of the rod with one hand, presses a hand float over the sheet as it uncoils and attaches it to the rendered face of the wall. This is continued, the roll being slowly uncoiled as it is heated and attached, until the base is reached. The upper edge must be thoroughly heated and *sealed* to the horizontal damp proof course, and the lower edge should be heated and lapped 3-in. over the floor damp proof course previously laid. Each successive vertical layer of sheeting must be thoroughly sealed by heat and pressure at the lapped joints.

The inner $4\frac{1}{2}$-in. wall is built after the concrete loading floor has been formed, a $\frac{3}{8}$ or $\frac{1}{2}$-in. cavity being left between the leaf and the asphalt and filled with grouted cement as described on p. 55 in connection with detail B. It is usual for this inner leaf to be continued up to the basement ceiling.

Bituminous sheeting may also be applied next to a $4\frac{1}{2}$-in. leaf as at D or externally as at E.

Damp Proofing of Floors.—The concrete floors shown at D, E, F and G are shown with a damp proof course over the concrete subfloor. Such provision is necessary if the site is damp (see waterproofed concrete floors on p. 57). The course may be either of asphalt mastic or fibrous asphalt felt.

The surface of the concrete must be absolutely dry before the asphalt is applied, otherwise adhesion will be adversely affected. It should be level and well brushed down. In order to promote adhesion, hot liquid asphalt, known as a *primer*, is brushed over the surface before the first coat of asphalt mastic is applied ; alternatively, the concrete may be covered with bituminous paper or *building paper* (one type consists of two layers of hemp impregnated with bitumen and covered with brown or kraft paper). This first coat of mastic, $\frac{3}{8}$-in., thick, is spread and floated over in bays not exceeding 4-ft. 6-in. ; the joint between a bay and that last formed is properly sealed by spreading the hot asphalt some 3-in. over the edge of that already laid to soften it, and after the superfluous asphalt has been removed, the joint is well floated or ironed until both edges are properly bonded and levelled. The second coat is applied direct on to the first, care being taken that the joints do not coincide with those below. If a third coat is required, this must also break joint with the second.

If fibrous asphalt felt is to be used, as shown at F, the concrete subfloor is primed and the bituminous sheeting is laid with 3-in. lapped joints, as described in the preceding column for vertical sheeting, the sheets being heated as they are uncoiled and floated on to the floor. As any sharp projections on the surface of the subfloor may tear the sheeting, it is advisable to cover the concrete with a $\frac{1}{2}$-in. thick layer of cement mortar. It is also desirable to cover the sheeting with a 1-in. layer of cement mortar to prevent damage when the concrete of the loaded floor is deposited. This also ensures a good backing for the damp proof course, which is very essential if water pressure has to be resisted.

In order to prevent damage being caused to the horizontal damp proof course by the upward pressure of subsoil water, it is often necessary to reinforce the concrete by a continuous layer of expanded metal or other steel reinforcement placed about 1-in. below the damp proof course. Similar reinforcement, placed approximately 1-in. from the top, is also usually provided in the concrete loading floor. Such reinforcement resists the tension stresses created.[1] In all such construction the loading floors should be tied or built-in to the walls, as shown at D, E, F and G.

Treatment of Damp Existing Basement Walls.—The absence of vertical damp proof courses is a frequent cause of dampness in walls of existing basements.

One method of curing such dampness is to apply a bituminous sheeting vertical damp proof course to the internal face of the wall, similar to that shown at F and described in the preceding column, and to construct a $4\frac{1}{2}$-in. brick (or concrete) wall from the floor to the ceiling.

Alternately, asphalt mastic may be applied to the internal faces of the walls after any plaster has been removed and the joints well raked out. Two coats of asphalt may be rendered as described in connection with detail D and a $4\frac{1}{2}$-in. brick lining constructed, or this inner lining may be built with a $\frac{3}{4}$-in. cavity between, into which the liquid mastic is poured (see description on p. 55 in respect to detail C). If a wall exceeds 9-ft. in height, it is desirable to bond the new $4\frac{1}{2}$-in. brick lining to it ; this is effected by forming 5-in. by 5-in. by 4-in. high pockets (one per square yard) in the existing wall, lining these with asphalt mastic, and building in headers from the new wall during its construction.

If the wall can be treated externally, the vertical asphalt damp proof course may be applied on the outer face, as shown at E.

When the floor, in addition to the walls, of an existing basement is damp, it is advisable to take up the floor, replace it with at least 6-in. thickness of concrete (1 : 2 : 4) and cover it with a $\frac{3}{4}$-in. double layer of *coloured asphalt* before the walls are treated. This can be obtained in various colours, and provides a noiseless, damp-resisting and hygienic finish. Occasionally the layer of asphalt

[1] See Vol. IV.